Quarterly Progress Report

January-March 1995

Mark R. Abbott
College of Oceanic and Atmospheric Sciences
Oregon State University

MODIS Team Member, Contract # NAS5-31360

Near-Term Objectives

1) Analyze data from field work in Southern Ocean
2) Deploy bio-optical mooring deployment at Hawaii Ocean Time Series station
3) Continue development of information management system
4) Continue to review plans for EOSDIS and assist ECS contractor
5) Complete error analysis for Fluorescence Line Height product
6) Participate in Miami workshop on calibration/validation of multiple ocean color missions

Task Progress

1) Southern Ocean Data

In December 1994, Dr. Ricardo Letelier participated in the "Studies in Antarctica: Coupled Linkages Among Microorganisms" led by Dr. David Karl (University of Hawaii). The cruise took place on the western side of the Antarctic Peninsula. Our objectives were to 1) characterize passive fluorescence of chlorophyll at the sea surface and 2) analyze the variability of this signal in relation to physiological and other environmental parameters. A Tethered Spectral Radiometer Buoy was routinely deployed to measure near-surface upwelling radiance. Two free-drifting buoys with spectroradiometers were also deployed. Primary productivity and pigment measurements were also made. Preliminary results show strong variations in the pigment/fluorescence relationship coincident with changes in salinity. One of the drifters beached after 70 days; the second

drifter continues to operate. Dr. Letelier continues to analyze the productivity data.

2) Deploy bio-optical mooring

We completed construction of an inexpensive bio-optical mooring. A data logger and current meter, designed by Dr. Dale Pillsbury, were integrated with a Satlantic spectroradiometer to measure downwelling irradiance. The spectroradiometer was mated to a glass sphere which contained power and an Argos data relay system. The system was designed to be deployed in 5000 m of water using Kevlar line. The total cost of the system was less than expected at $17,000. We planned to deploy the mooring during the March HOTS cruise. Unfortunately, the shipper broke the glass sphere. The unit has been replaced and will be deployed during the April HOTS cruise.

3) Information Management

We now have a complete data management system based on Microsoft's SQL Server. Using Object Linking and Embedding (OLE) as well as Open Data Base Connectivity (ODBC), we have clients based on off-the-shelf applications such as Axum (a technical graphing and analysis product) and Excel. We continue to load bio-optical data from the California Current drifter experiment into the data base. We have built and implemented a Mosaic client as well.

4) EOSDIS

I participated in the Preliminary Design Review Wrap-Up session for the ECS contractor. ECS appears to be making good progress, but there are still concerns about the cost model and about ECS' ability to produce all of the MODIS standard products.

In response to a request from Ed Masuoka, I developed a data flow diagram and description for my standard products. These were provided to GSFC and to Bob Evans at the University of Miami.

5) Error analysis

Dr. Letelier and I have conducted an error analysis of the Fluorescence Line Height (FLH) algorithm. We tested the effects of changing atmospheric turbidity as well as shifts in band position. Without pixel averaging, the minimum chlorophyll value that will be detectable is about

0.8 mg/m^3 for typical atmospheres and fluorescence to chlorophyll conversion factors. If 4 by 4 pixels are averaged, the minimum values is about 0.2 mg/m^3. Shifts in wavelength can have significant impacts on FLH, especially if these shifts are independent between bands. Changes of 20-30% are not unexpected from small shifts of a few nm. Lastly, errors in the fluorescence to chlorophyll conversion factor are more important than errors in atmospheric correction. A draft version has been sent to Ed Knight (GSFC) for comments. A final report will be submitted to GSFC in the next few weeks.

6) Miami Calibration/Validation Workshop

Dr. Letelier and I participated in the Miami workshop that focused on blending ocean color data from all of the planned ocean color missions. This is the first step in a NASA/GSFC program to develop international agreements for data sharing, bio-optical protocols, standard algorithms, and data fusion techniques to develop a comprehensive suite of ocean color products suitable for climate research.

Anticipated Activities

1) Bio-Optical Mooring

The mooring off Hawaii will be recovered in May. We will analyze these results and prepare a proposal for the JGOFS Southern Ocean program to deploy similar moorings in the Polar Front.

2) Field Work

We are finishing analysis of the California Current drifters and preparing three manuscripts: a paper on the theory of fluorescence, a paper on the bio-optical properties of the California Current, and one on the Lagrangian statistics of the flow field and bio-optics. Dr. Letelier is also preparing a paper on the Southern Ocean results.

3) Information Management

We will continue to develop additional clients for our SQL Server data base. We are developing objects for data overlay and analysis.

4) Laboratory Work

Dr. Letelier will work with Dr. Paul Falkowski (Brookhaven National Laboratory) this summer on laboratory studies of sun-stimulated fluorescence. We will also set up phytoplankton culture experiments in our lab. Our plan is to use a fast repetition rate fluorometer as well as measurements of passive fluorescence to study the effects of species changes and light history on productivity and passive fluorescence.

Problems/Corrective Actions

Equipment approvals took longer than expected, resulting in mismatches between price quotes and the eventual invoices.